Space Weather Technical Forecast

Issued on Saturday 26 October 2024 at 01:29 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: M-flares likely, slight chance of further X-flares. Chance of G1-G2/Minor-Moderate geomagnetic storm intervals day 1 (26 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate in the past 24 hours with an isolated M1.1 flare at 25/0733 UTC originating from AR3873, located in the far southeast.

There are currently eleven sunspot regions on the disc. The main focus is a cluster in the southeast of the disc, with three significant regions located here. These are (from west to east) AR3869, AR3872, and AR3873. AR3869 and AR3872 maintain fairly complex appearances with the latter possessing a delta configuration in the main large trailer spot. AR3873 appears to be a moderately sized bipolar region, with a elongated asymmetric trailing spot. AR3874 and AR3875, minor regions in the northeast were numbered, during the period as was AR3876 in the southeast. AR3871 in the southeast decayed.

No new Earth directed CMEs (coronal mass ejections) were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds were indicative of Background conditions. Speeds, observed by ACE at L1, were Slow-ambient, generally varying between 300-350km/s. Density was mainly Below Average. The Interplanetary Magnetic Field (IMF) remained Weak, between 2-7nT. The north-south component of the IMF was also Weak. Phi angle was mainly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels. High energy electron flux (greater than 2MeV) observed by GOES16 remained at mainly Background. The associated 24-hour fluence was well below the Active threshold, with 1.71e6 integrated flux observed at 26/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with M-class flares considered likely and a slight chance of X-class flares, most probable from the numerous active regions in the southeast disc.

Solar Wind / Geomagnetic Activity: A CME resulting from the X3.3 of AR3869 on 24 Oct has been remodelled as a flanking impact at Earth on day 1 (26 Oct). This may combine with one or more

---

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

weak CMEs that left the Sun on 22/23 Oct which have a small chance of a glancing impact, also on day 1 (26 Oct).

Solar winds are currently at Background levels. The onset of a fast wind from a coronal hole is expected on day 1 (26 Oct) with speeds peaking at Slightly Elevated or Elevated, before waning on day 2 (27 Oct). It is likely that CME influence may mask this enhancement, particularly on day 1 (26 Oct) with speeds peaking at Elevated to Strong levels following any arrival. Mainly Background winds are expected on days 3 and 4 (28 and 29 Oct).

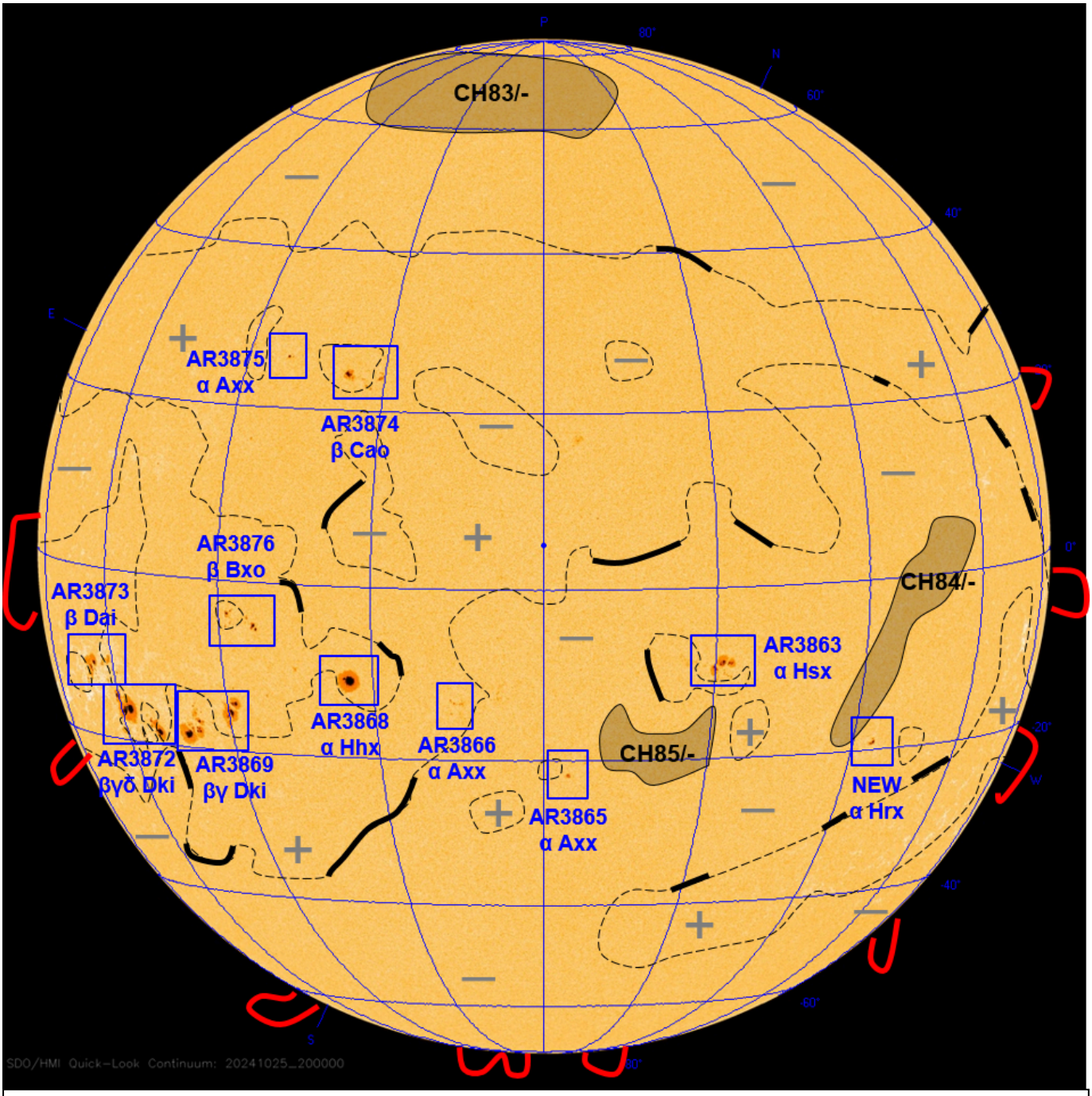
Activity is expected to be Quiet to Active on day 1 (26 Oct) with a chance of peak G1/Minor to G2/Moderate Storm conditions should geomagnetic conditions be favourable following the CME arrival. Activity should be Quiet to Active on day 2 (27 Oct), with a slight chance of G1/Minor Storm conditions at first. From day 3 (28 Oct) onwards activity should return to Quiet to Unsettled levels, although further flare and CME activity from the numerous active regions in the southeast disc could change this.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at Background. High energy electron flux at GOES16 is forecast to remain at mainly Background levels, with the associated 24 hour fluence remaining well below the Active (1e8 integrated flux) threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: MOSWOC Solar Synoptic Map valid 25/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

A number of weak CMEs from 22/23 Oct have been modelled to miss Earth, although there remains a small element of uncertainty in the nature of the CME observed around 23/1200UTC in the southeast disc and the potential for an Earth-directed component and glancing blow on day 1 (26 Oct). The main CME of note for the forecast period is from the X3.3 flare of AR3869 at 24/0357 UTC. The CME originated from the far southeast disc, but a flanking impact is now expected on day 1 (26 Oct) following remodelling of this feature. The CME may also may sweep up the previously mentioned CMEs. Background Enlil solar wind speeds are higher than are currently being observed, therefore the arrival time of the latter, more significant CME on day 1 (26 Oct) is likely to be later than indicated in the model.

Solar winds are currently at Background levels. The onset of a fast wind from CH84/- is expected on day 1 (26 Oct) with speeds peaking at Slightly Elevated or Elevated (based on recurrence), before waning on day 2 (27 Oct). It is likely that CME influence may mask this enhancement, particularly on day 1 (26 Oct) with speeds peaking at Elevated to Strong levels following any arrival. Mainly Background winds are expected on days 3 and 4 (28 and 29 Oct).

Activity is expected to be Quiet to Active on day 1 (26 Oct) with a chance of peak G1/Minor to G2/Moderate Storm conditions should geomagnetic conditions be favourable following the CME arrival. Activity should be Quiet to Active on day 2 (27 Oct), with a slight chance of G1/Minor Storm conditions at first. From day 3 (28 Oct) onwards activity should return to Quiet to Unsettled levels, although further flare and CME activity from the numerous active regions in the southeast disc could change this.

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	50	10	1	1
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

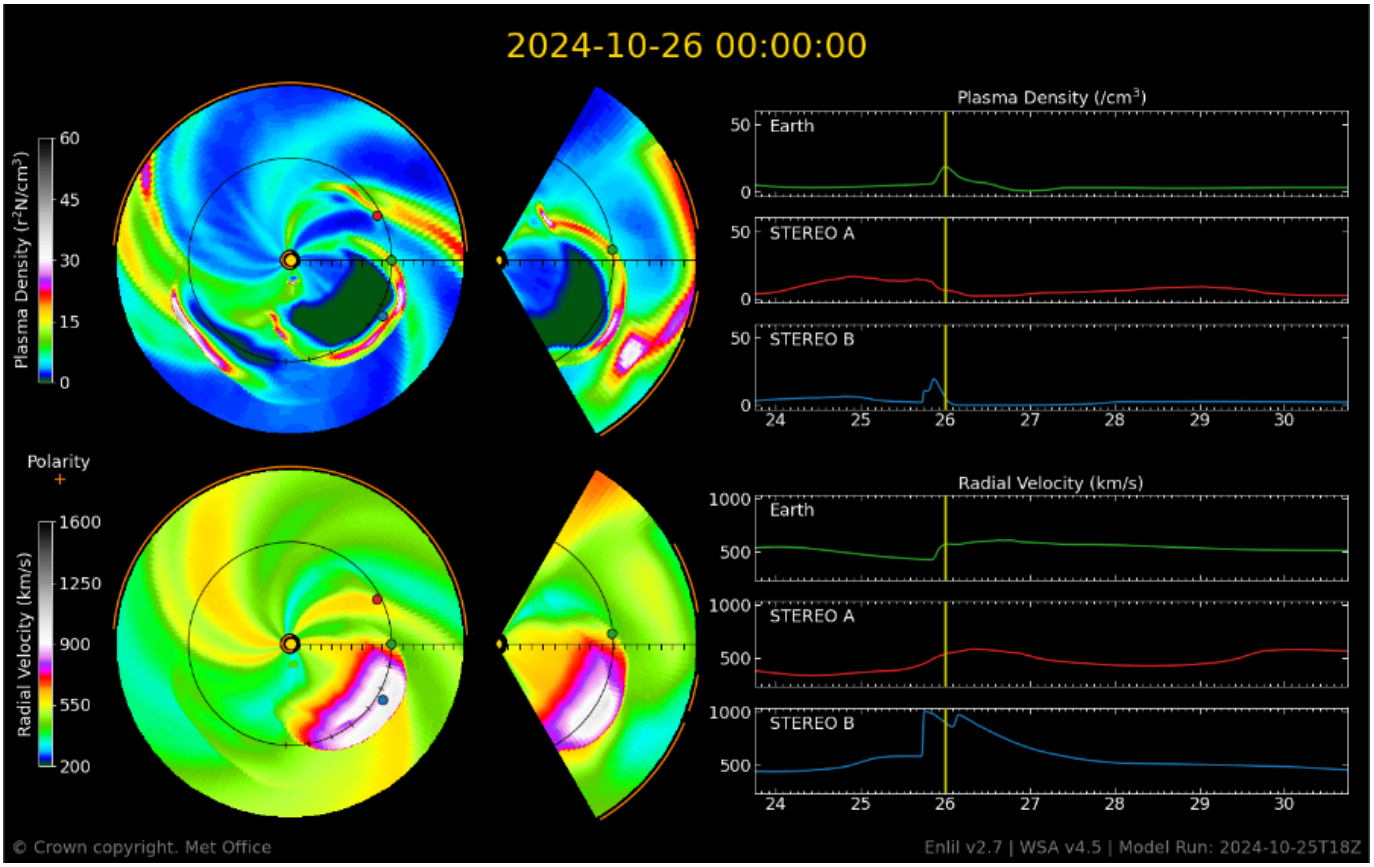
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Activity - Earthbound Coronal Mass Ejections

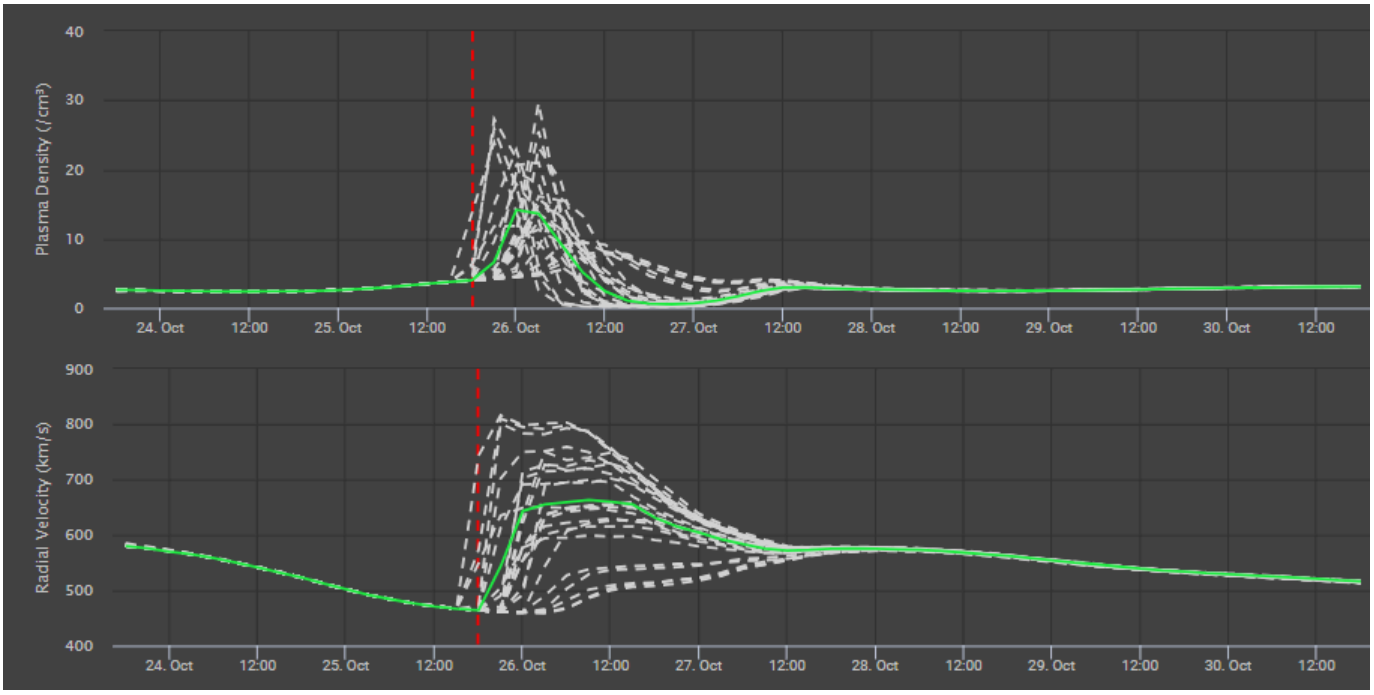
Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
2024-10-24 06:21	Partial	X3.3 flare (AR3869)	SE	1383	26/0700 UTC	Moderate-high confidence in arrival. Arrival -7/+10 hours.

Figure 2: MOSWOC Enlil showing flanking impact of CME from X3.3 flare of AR3869 on 24 Oct. Arrival expected later than Enlil modelling due to ongoing estimation of background solar wind speeds.



© Crown Copyright 2024. All Rights Reserved.

Figure 3: MOSWOC Enlil Ensemble output.



© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

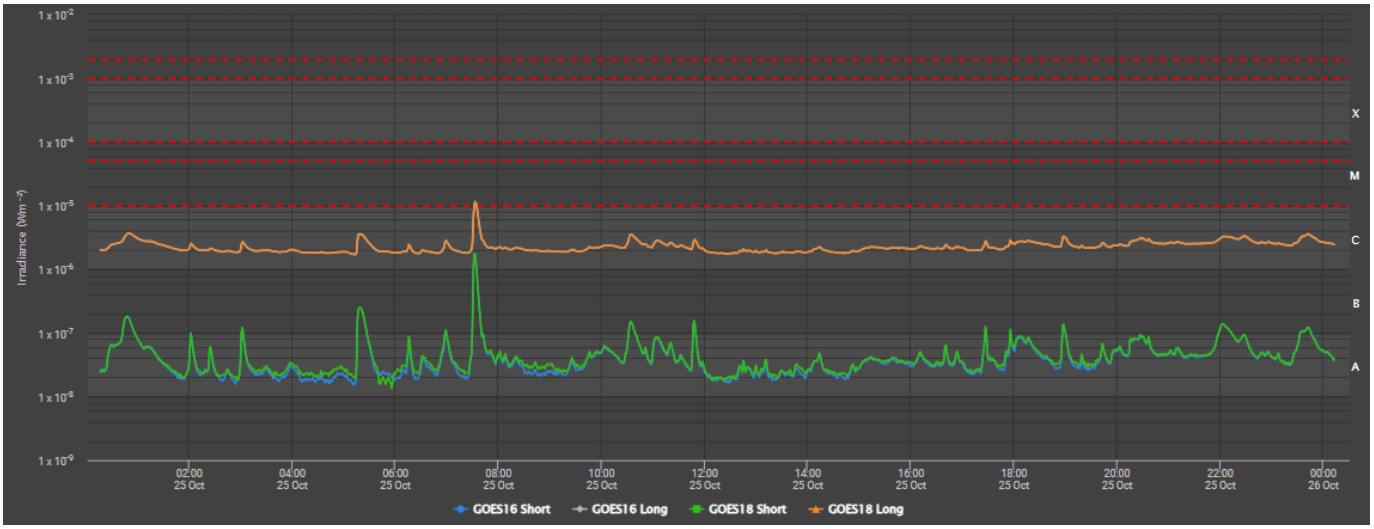
Solar activity has been Moderate in the past 24 hours with a single Moderate flare measuring M1.1 at 25/0733 UTC originating from AR3873 in the far southeast.

There are currently eleven sunspot regions on the disc. The main focus is toward the southeast of the disc, with three significant regions located here. These are (from west to east) AR3869, AR3872, and AR3873. AR3869 comprises of a number of mature spots in both leading and trailing regions, with moderate magnetic complexity. AR3872 has shown a tendency to consolidate some intermediate spots into either lead or trailer portions, and appears to have a delta configuration in the main large trailer spot. AR3873, near the east limb appears to be a moderately sized bipolar region, with an elongated asymmetric trailing spot and some slight emergence in the leading portion of the group. Most other regions on the disc are smaller or simple and generally exhibit only small changes in evolution.

Low to Moderate activity is expected with M-flares likely and a slight chance of isolated X-flares. These are most probable from the regions in the southeastern disc.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	60	60	60	60
Very Active	R3-R5 (X Class)	No	10	10	10	10

Figure 4: Latest GOES16/18 X-Ray flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is forecast to remain at Background, although some slight proton enhancement is possible should further significant flares occur. The current most active regions are located near the east limb, but will gradually transit toward centre disc by the end of the period allowing for a slightly greater risk of proton enhancements.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is currently at Background levels, and is expected to persist mainly at this level with no significant enhancements expected.

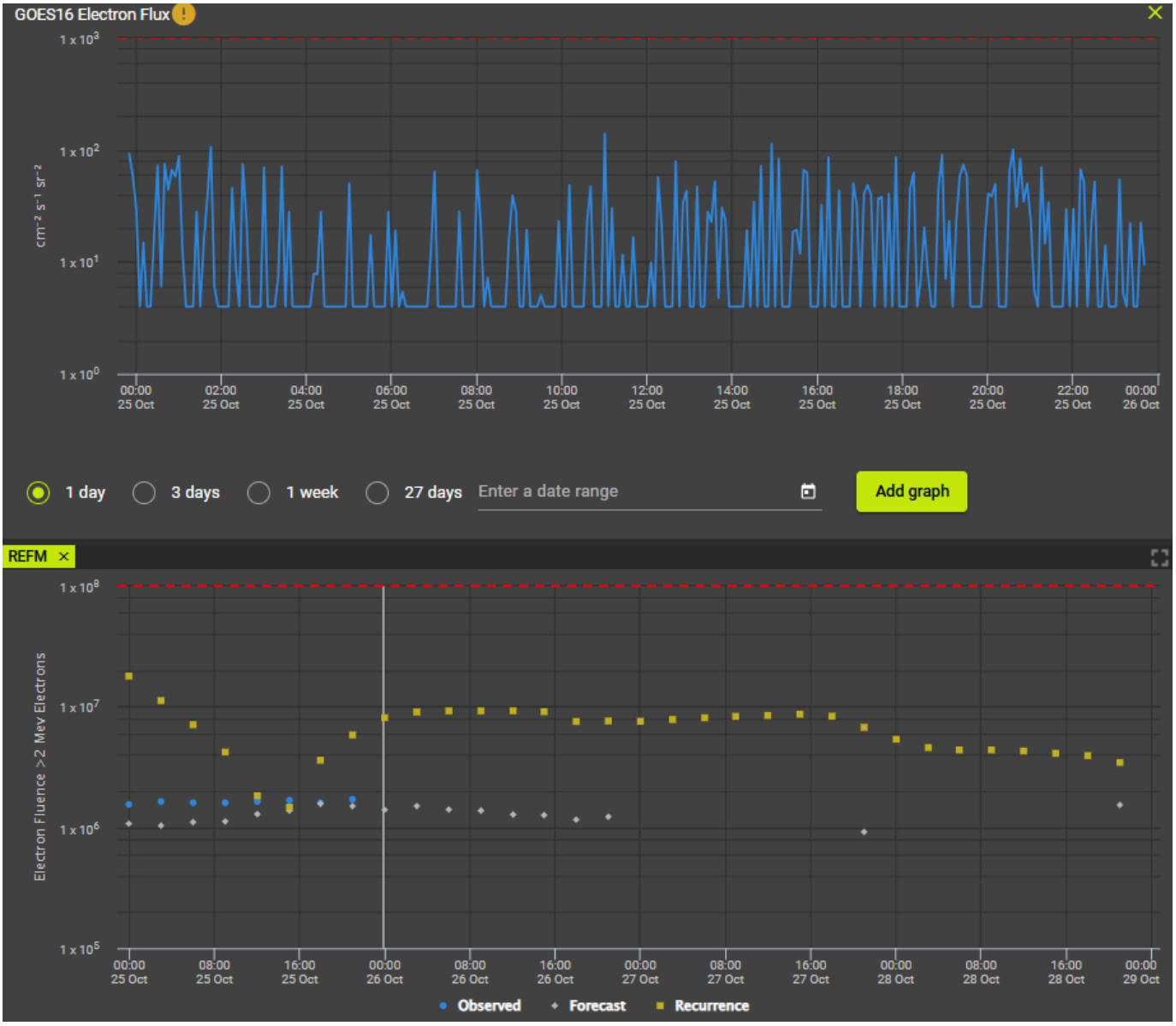
The associated 24-hour fluence is currently expected to remain well below Active throughout the period, with the MOSWOC REFM forecast providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 5: GOES16 >2MeV Electron Flux (above) and MOSWOC REFM forecast and recurrence (below)



© Crown Copyright 2024. All Rights Reserved.